

Fiber-Based Electro-Optic Field-Mapping System

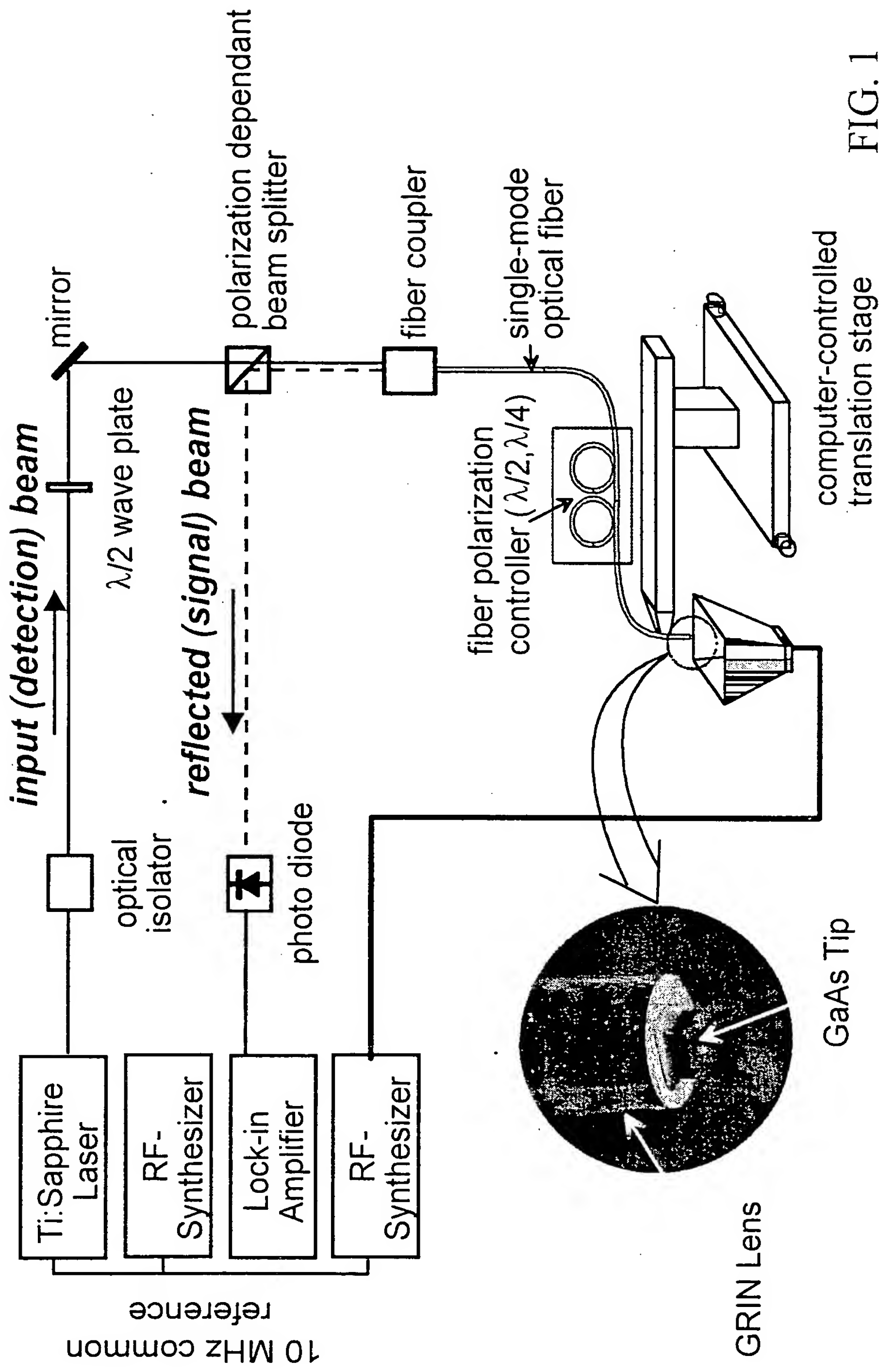


FIG. 1

Fiber-Based Electro-Optic Field-Mapping System

Polarization Control

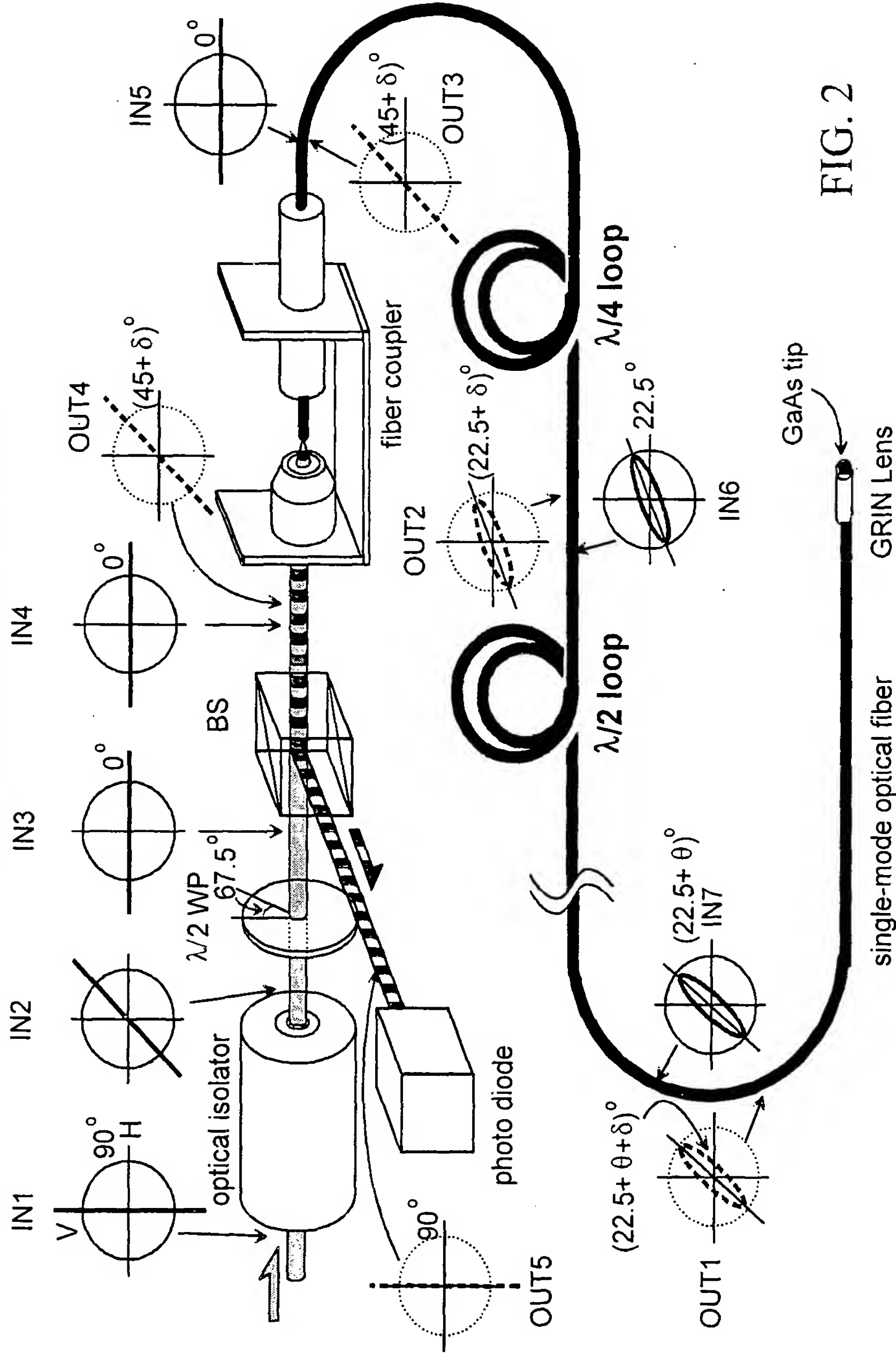
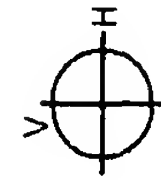
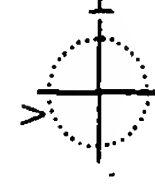


FIG. 2



detection (input) beam polarization (w.r.t. horizontal axis)



signal (reflected) beam (w.r.t. horizontal axis)

Fiber-Based Electro-Optic Sampling System *GRIN Lens*

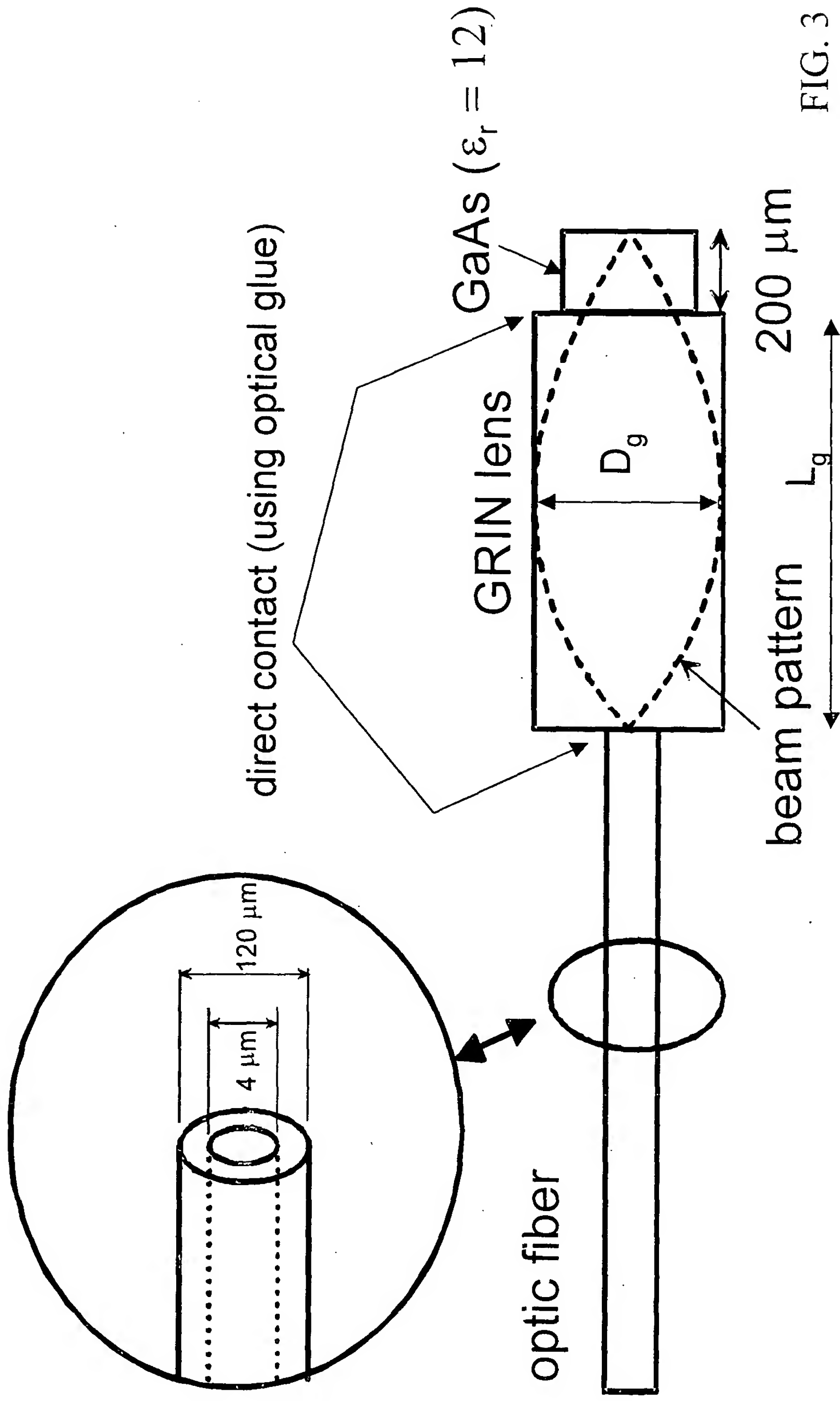


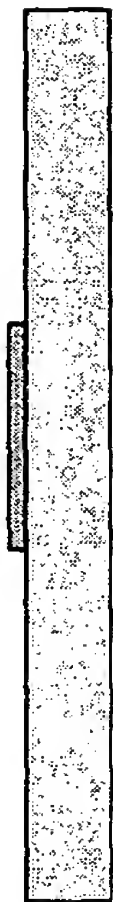
FIG. 3

Fiber-Based Electro-Optic Sampling System Probe Tip Fabrication Procedure

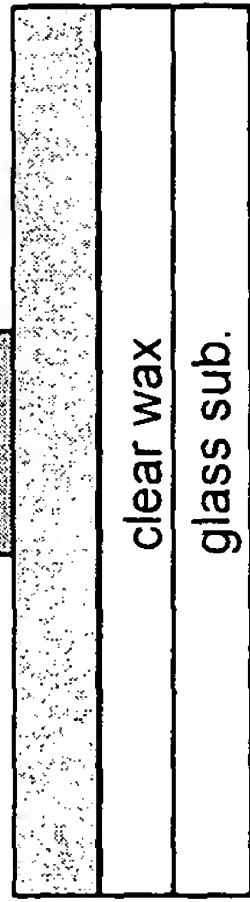


PR 1827 : 3.5 Krpm (30 sec), 105 C (1 min)

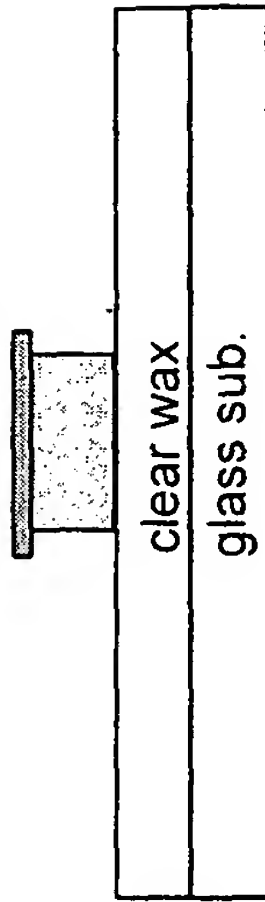
expose without mask (15 sec), develop (90 sec)



PR 1827 : expose (15 sec), develop (50 sec),
hard bake (105 C, 1 min)

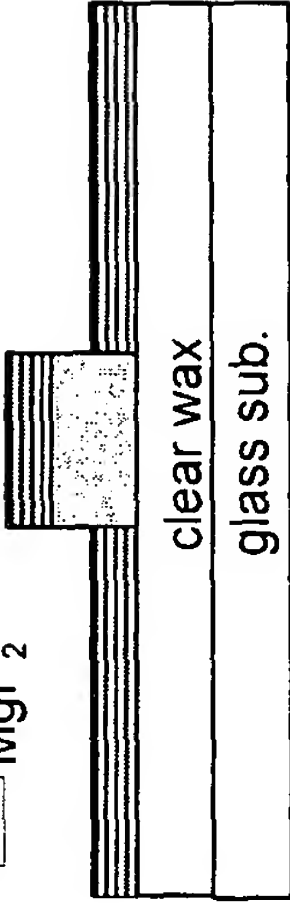


mount sample on glass substrate
using clear wax (on the 150 C hot plate)



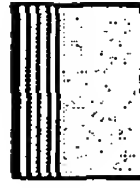
wet etching : H_2SO_4 : H_2O_2 : H_2O
= 1 : 8 : 1
+ few drops of NH_4OH
agitate 30 sec every 30 sec
change etchant every 10 min.

ZnSe
MgF₂



Distributed Bragg Reflector (DBR) deposition

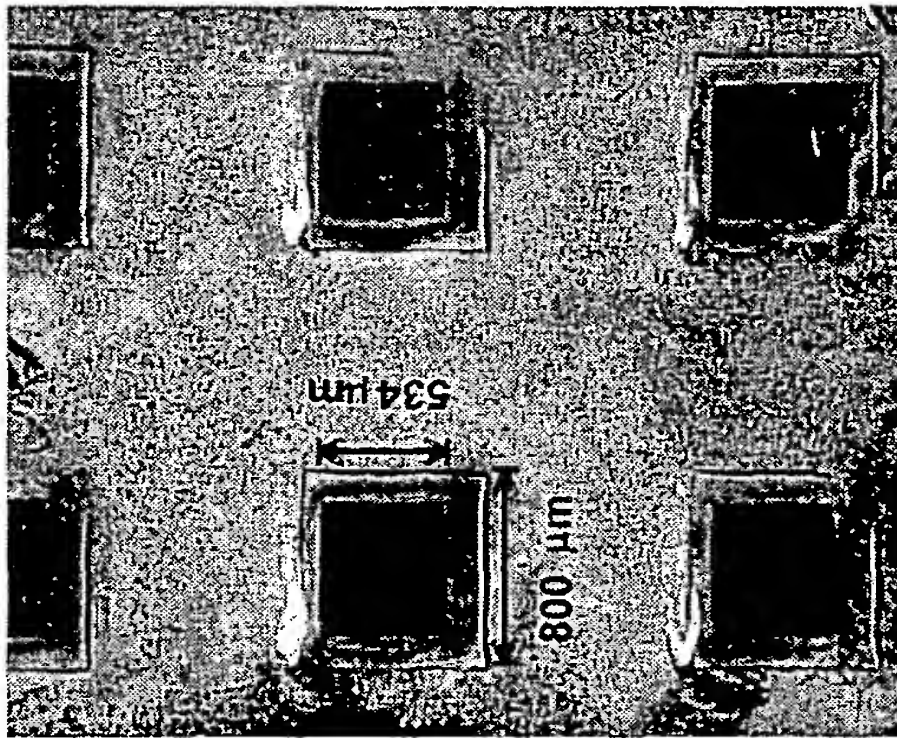
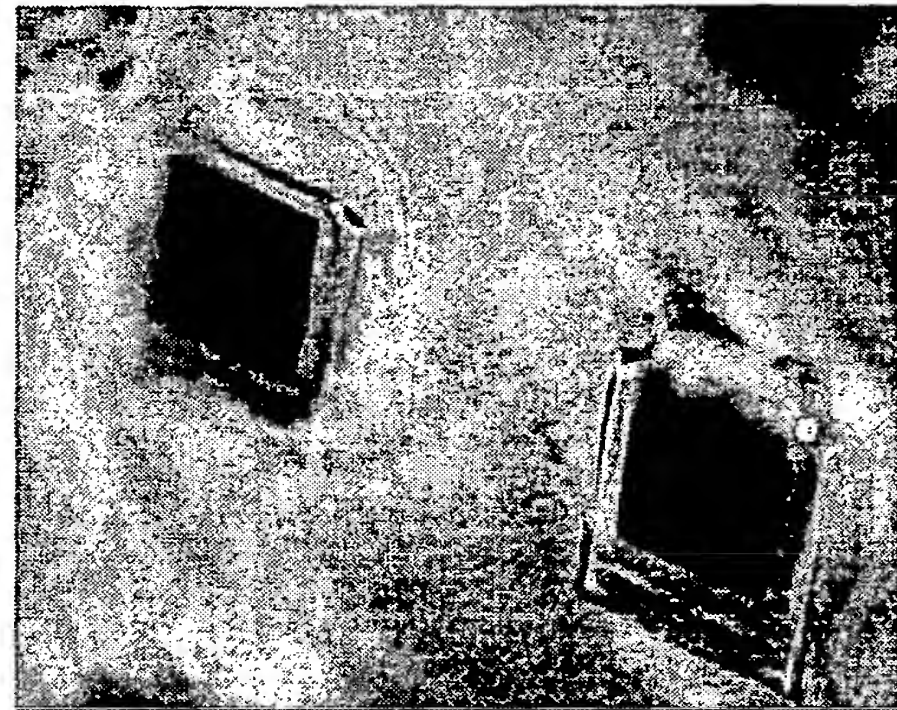
MgF₂ = 1,403 Å, ZnSe = 833 Å x 4 sets



Final probe tip
(released in the hot acetone)

FIG. 4

Fiber-Based Electro-Optic Sampling System Probe Tip Fabrication - (100) GaAs



etching depth ~ 160 μm (7.95 μm/min x 20 min)
 (lateral : 130~150 μm, 6.5~7.5 μm/min)

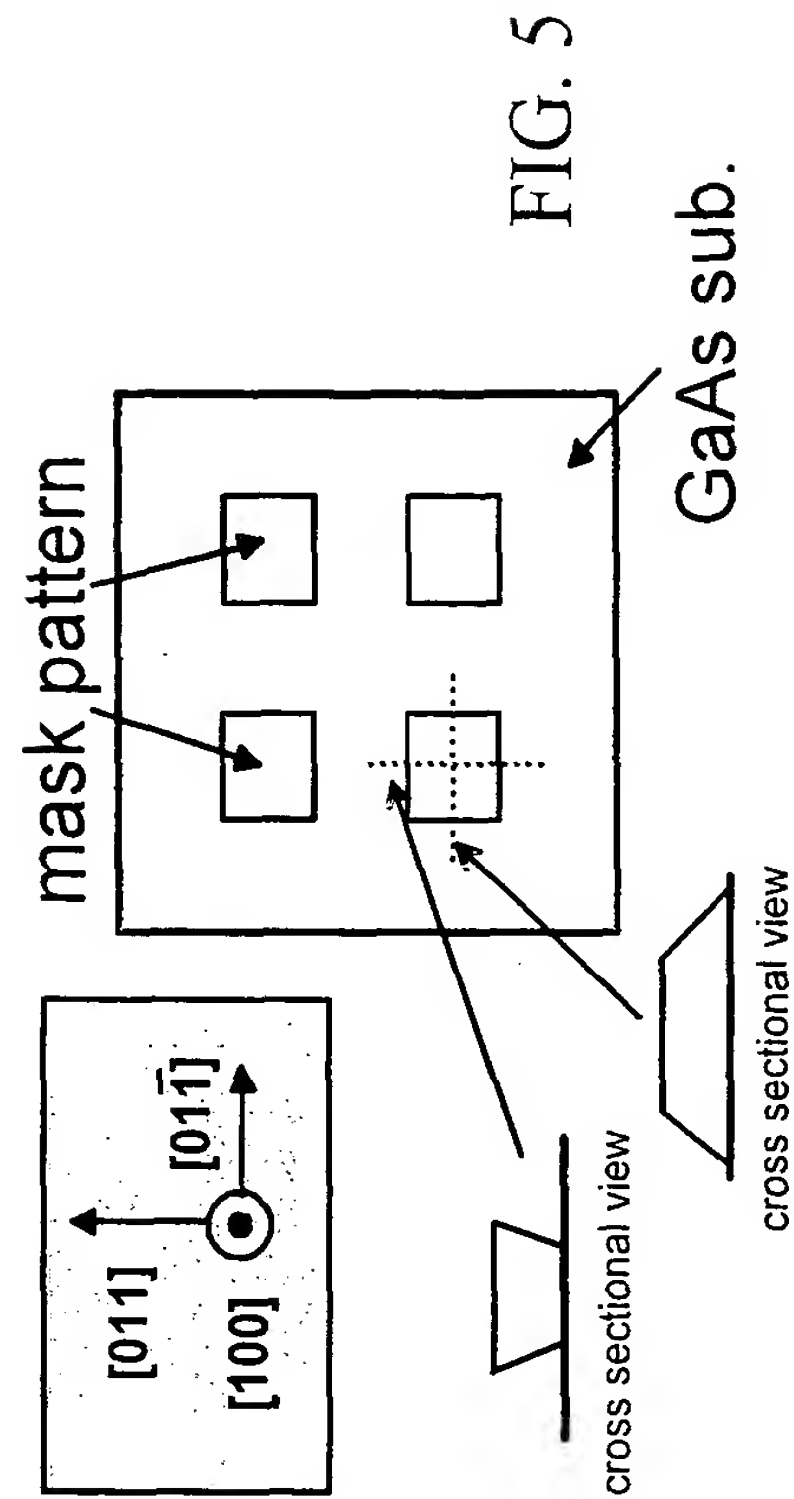
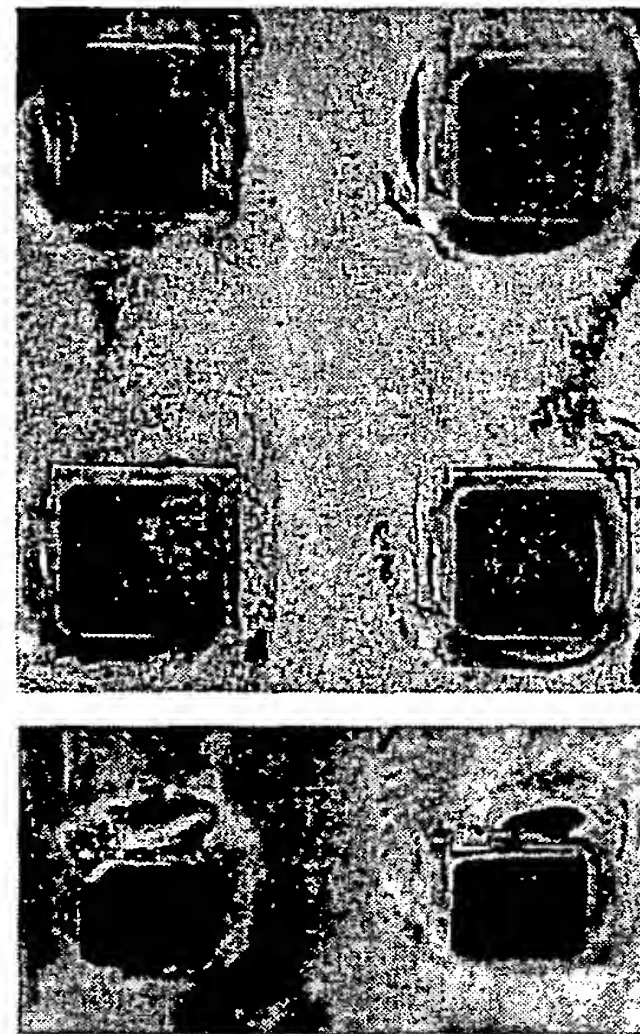
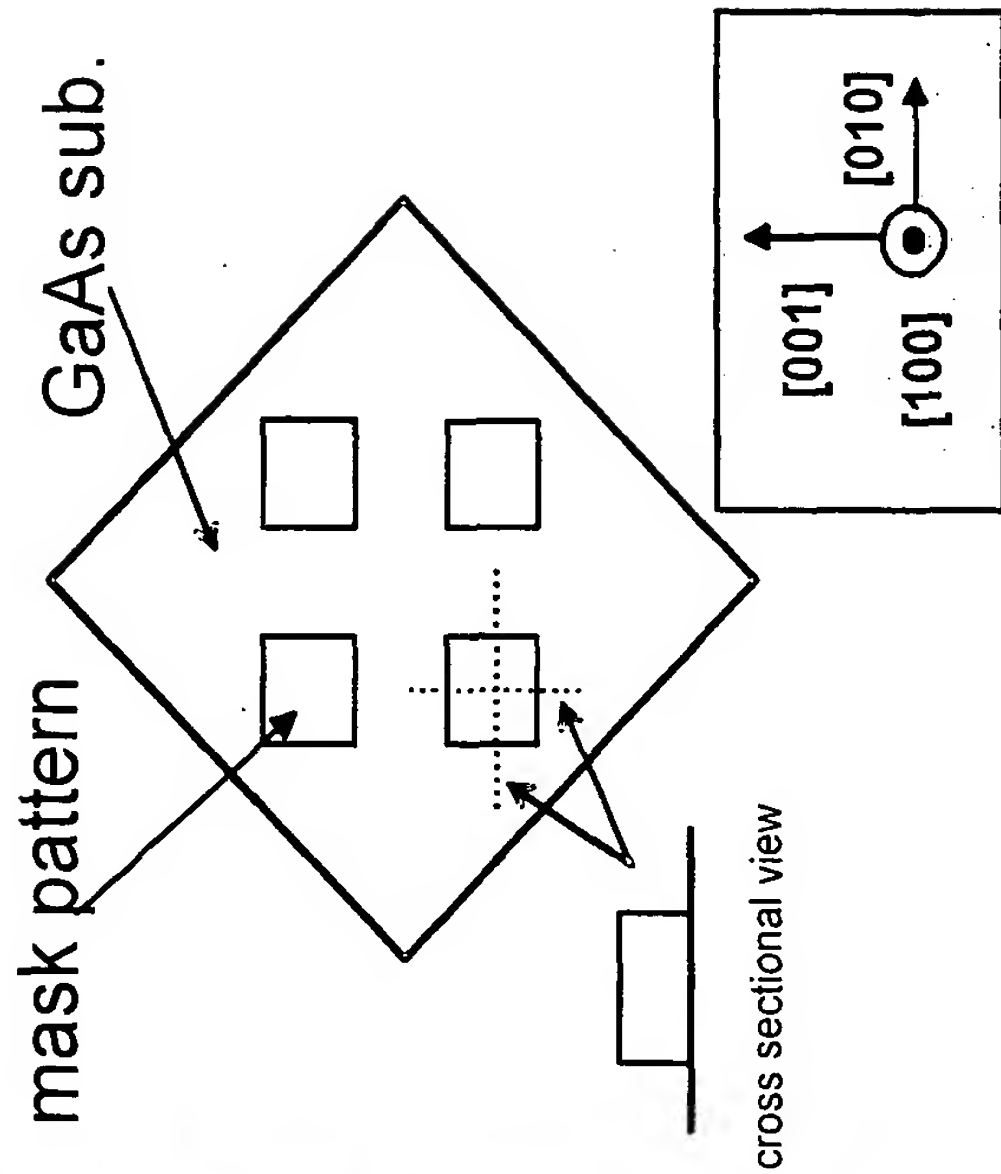


FIG. 5



Fiber-Based Electro-Optic Sampling System
Probe Tip Fabrication - (110) GaAs

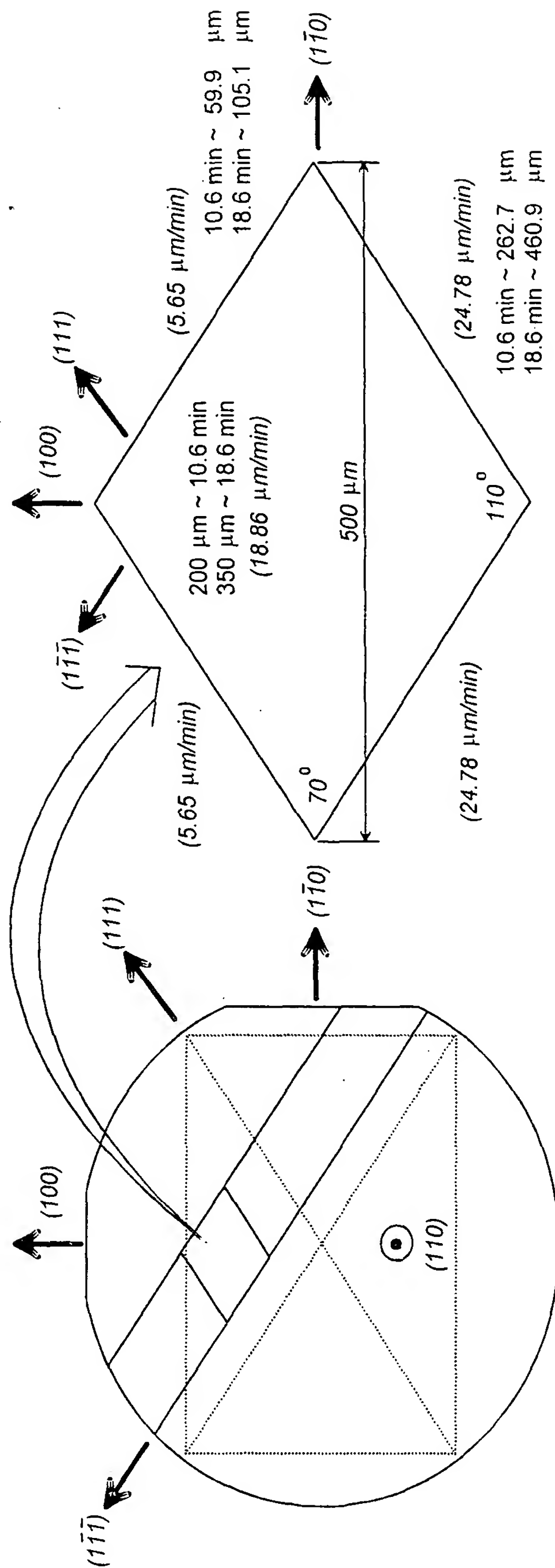
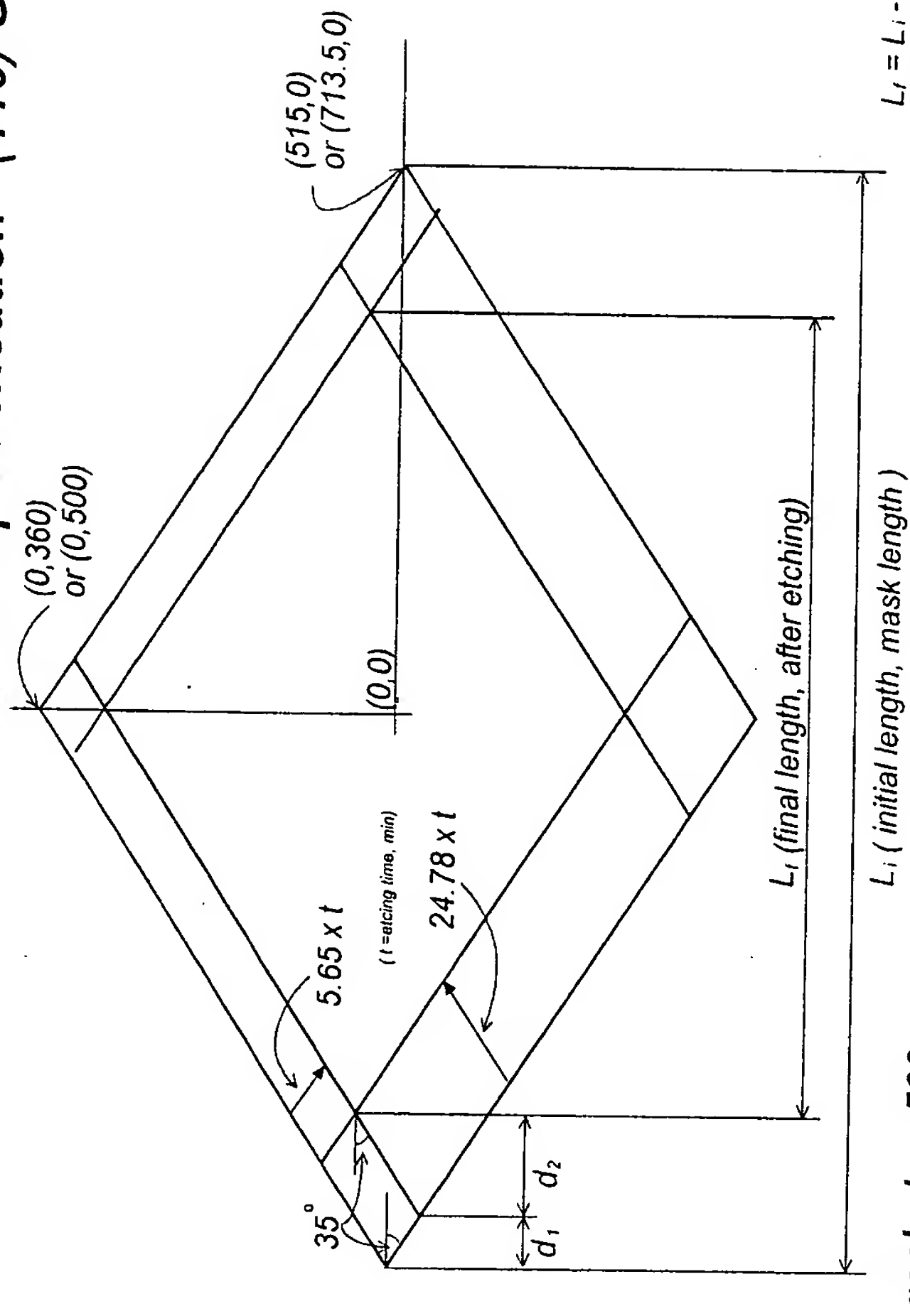


FIG. 6

Fiber-Based Electro-Optic Sampling System Probe Tip Fabrication - (110) GaAs



$$\begin{aligned}
 L_f &= L_i - (d_1 + d_2) \times 2 \\
 L_f &= L_i - [5.65 \times t \times \cos(35^\circ) + 24.78 \times t \times \sin(55^\circ)] \times 2 = 500 \\
 L_i &= 500 + [5.65 \times \cos(35^\circ) + 24.78 \times \sin(55^\circ)] \times 2 \times t
 \end{aligned}$$

where,
 $t = 200 / 18.86 \text{ (}\mu\text{m/min)} = 10.6 \text{ min for } 200 \text{ }\mu\text{m wafer}$
 $t = 350 / 18.86 \text{ (}\mu\text{m/min)} = 18.6 \text{ min for } 350 \text{ }\mu\text{m wafer}$
 (t = etching time, min)

▲ $L_i = 1029 \text{ }\mu\text{m for } 200 \text{ }\mu\text{m wafer,}$
 $= 1427 \text{ }\mu\text{m for } 350 \text{ }\mu\text{m wafer}$

FIG. 7

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Fiber-Based Electro-Optic Sampling System Probe Head Assembly

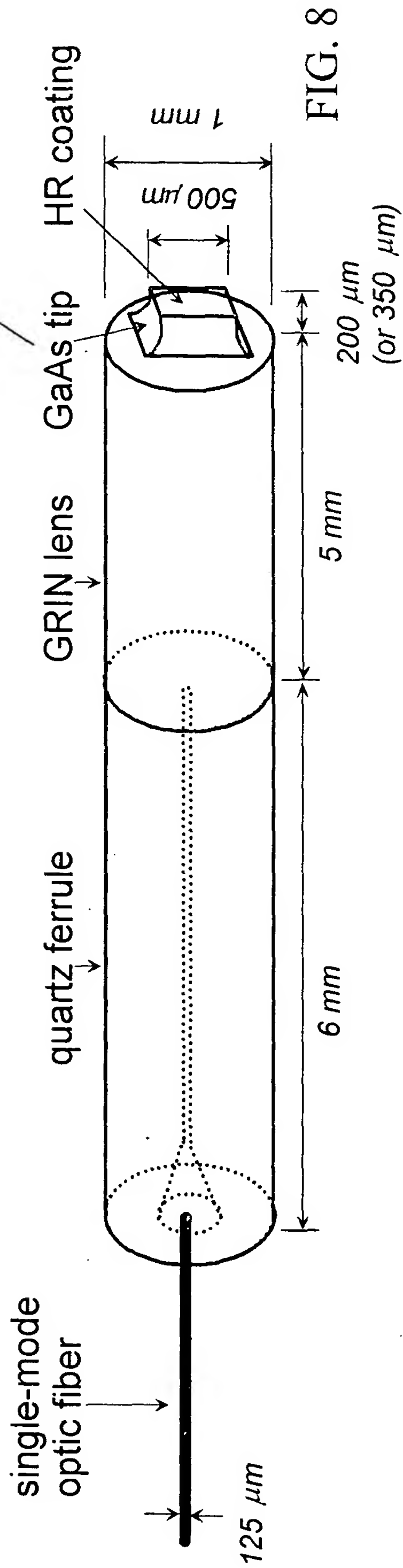
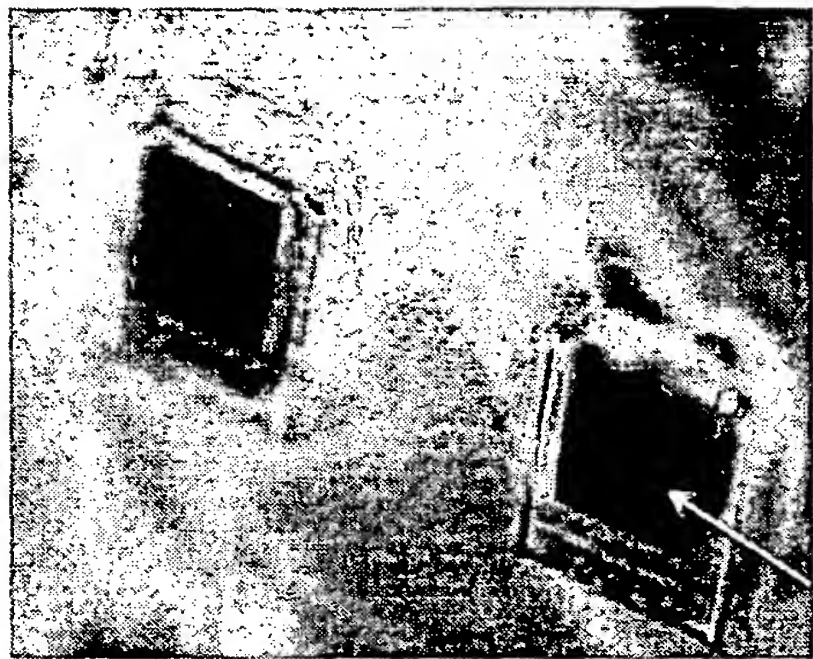


FIG. 8

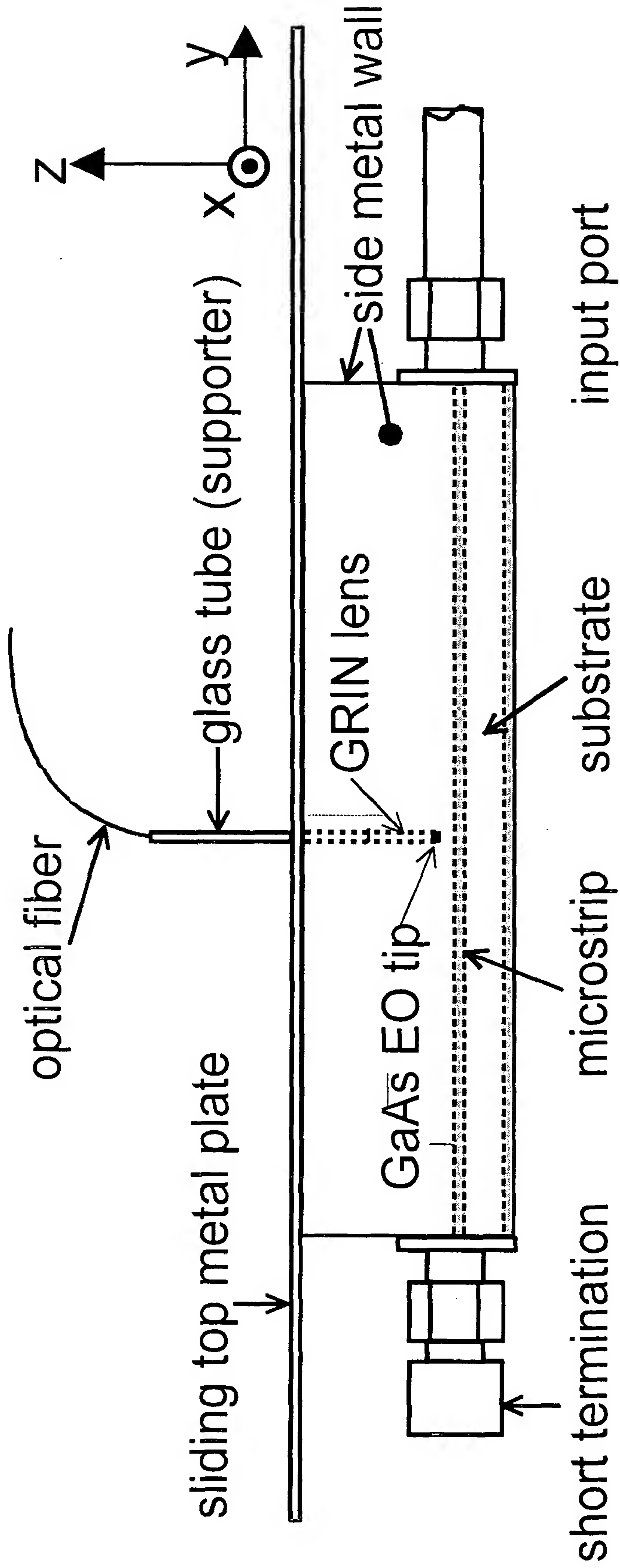


FIG. 9

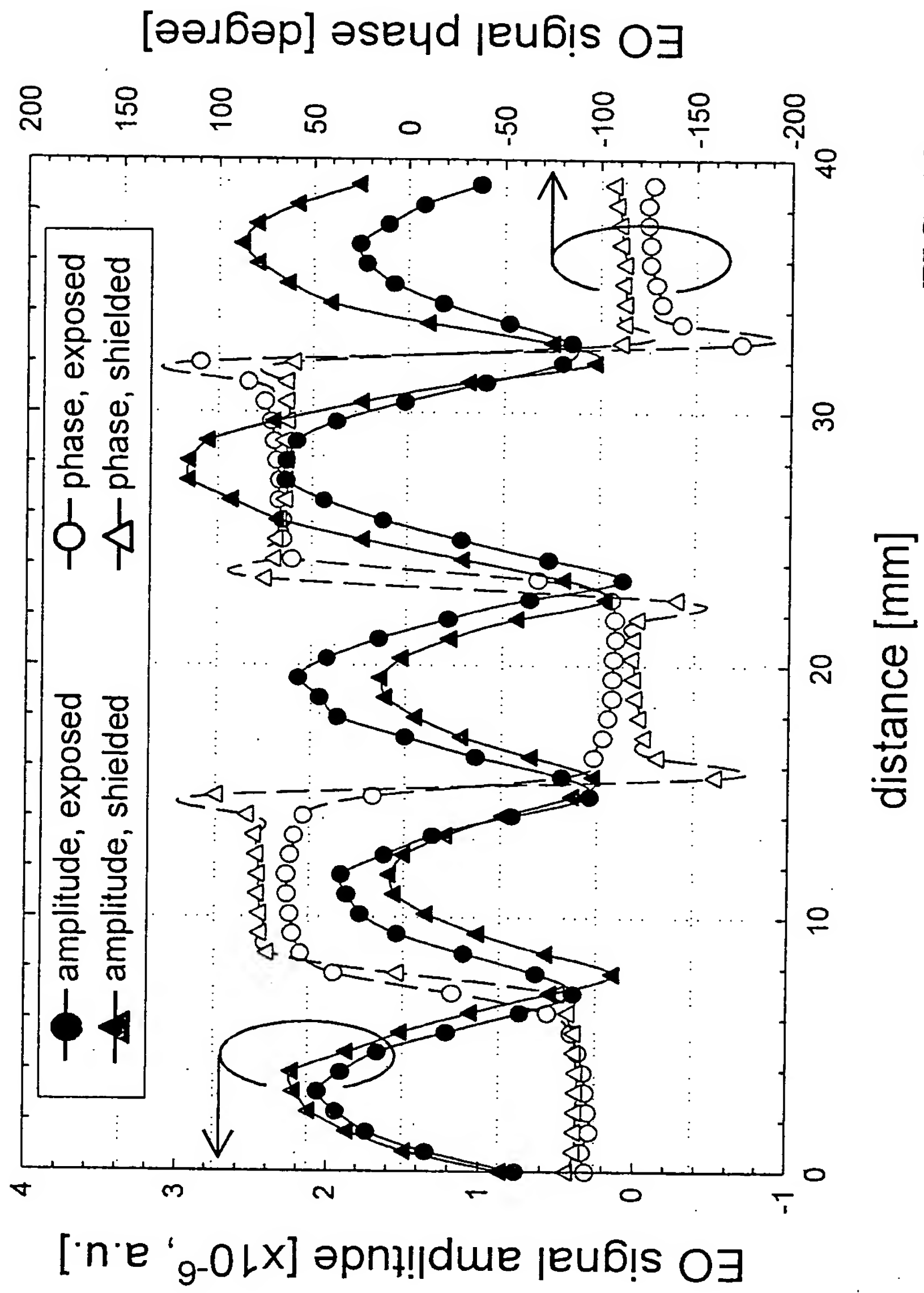
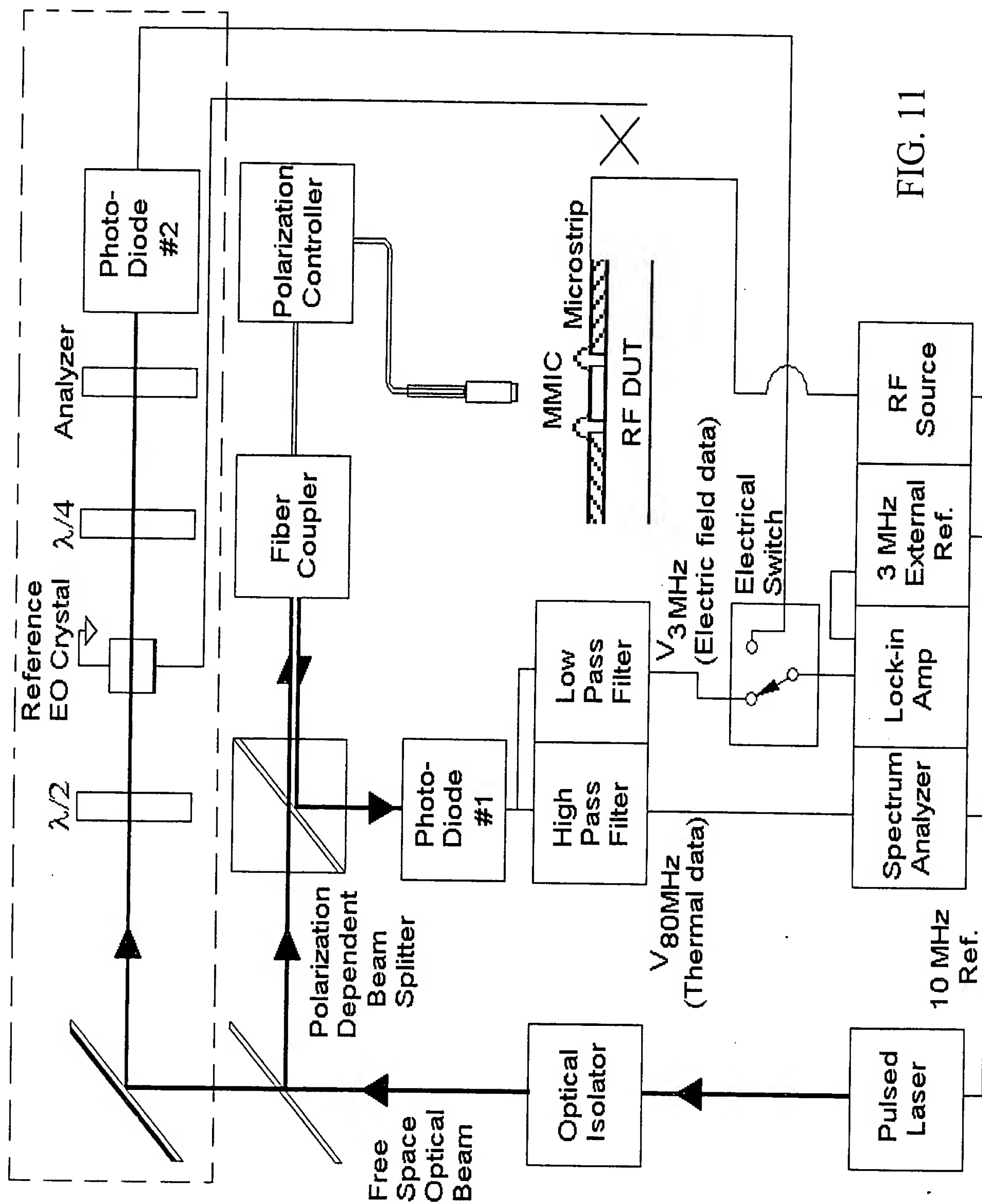


FIG. 10



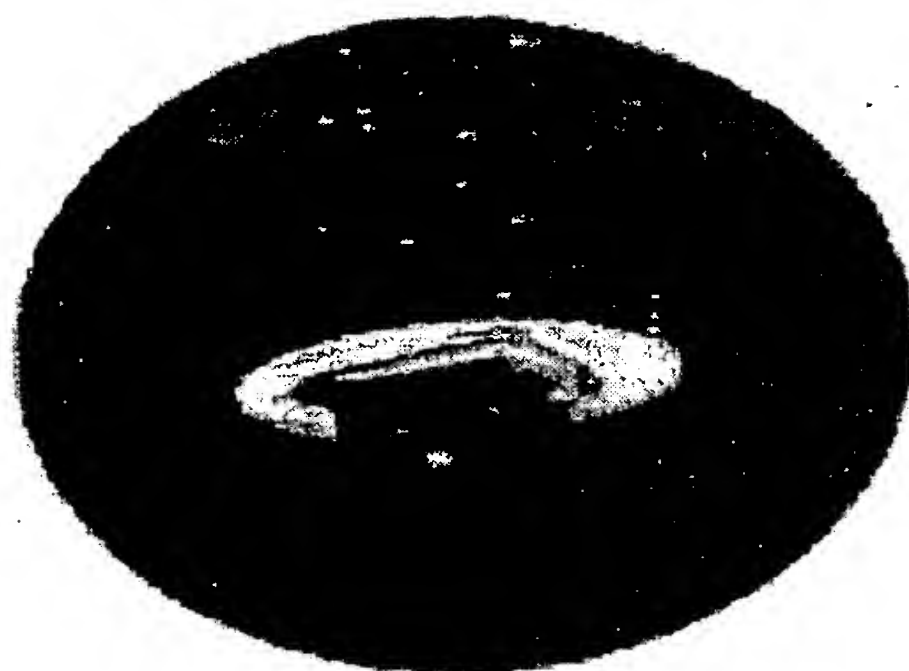


FIG. 12

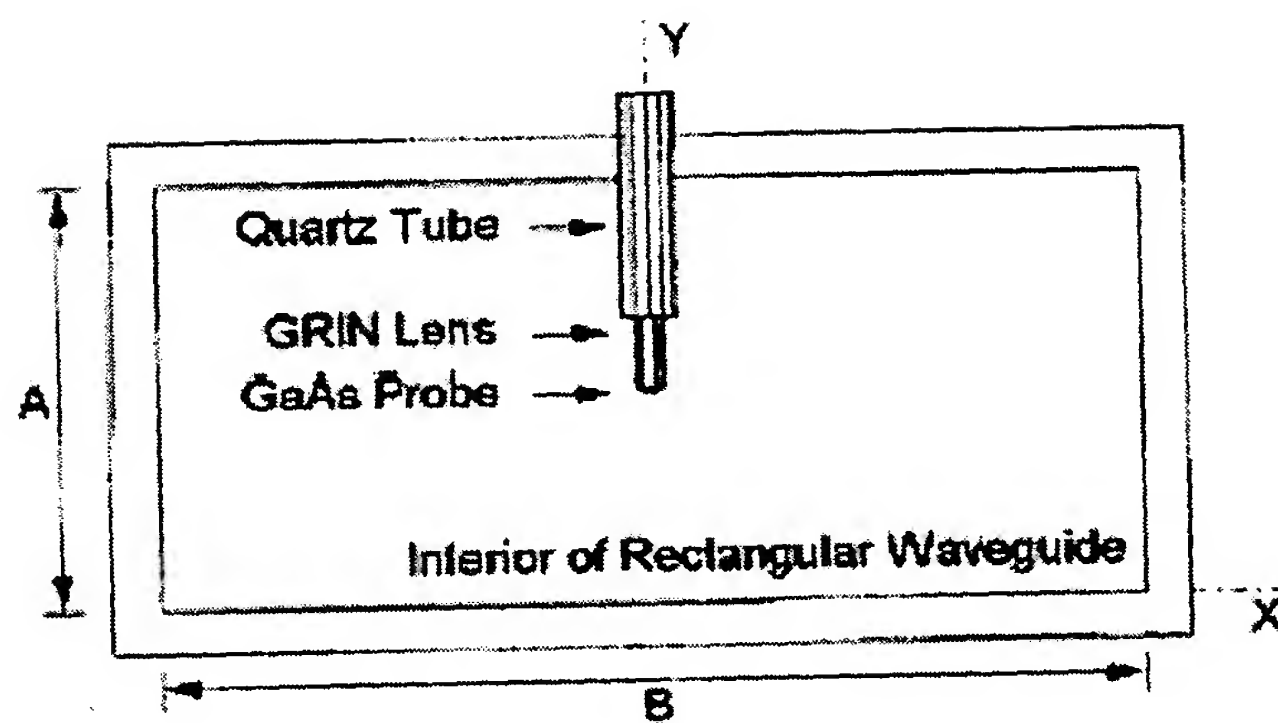


FIG. 13

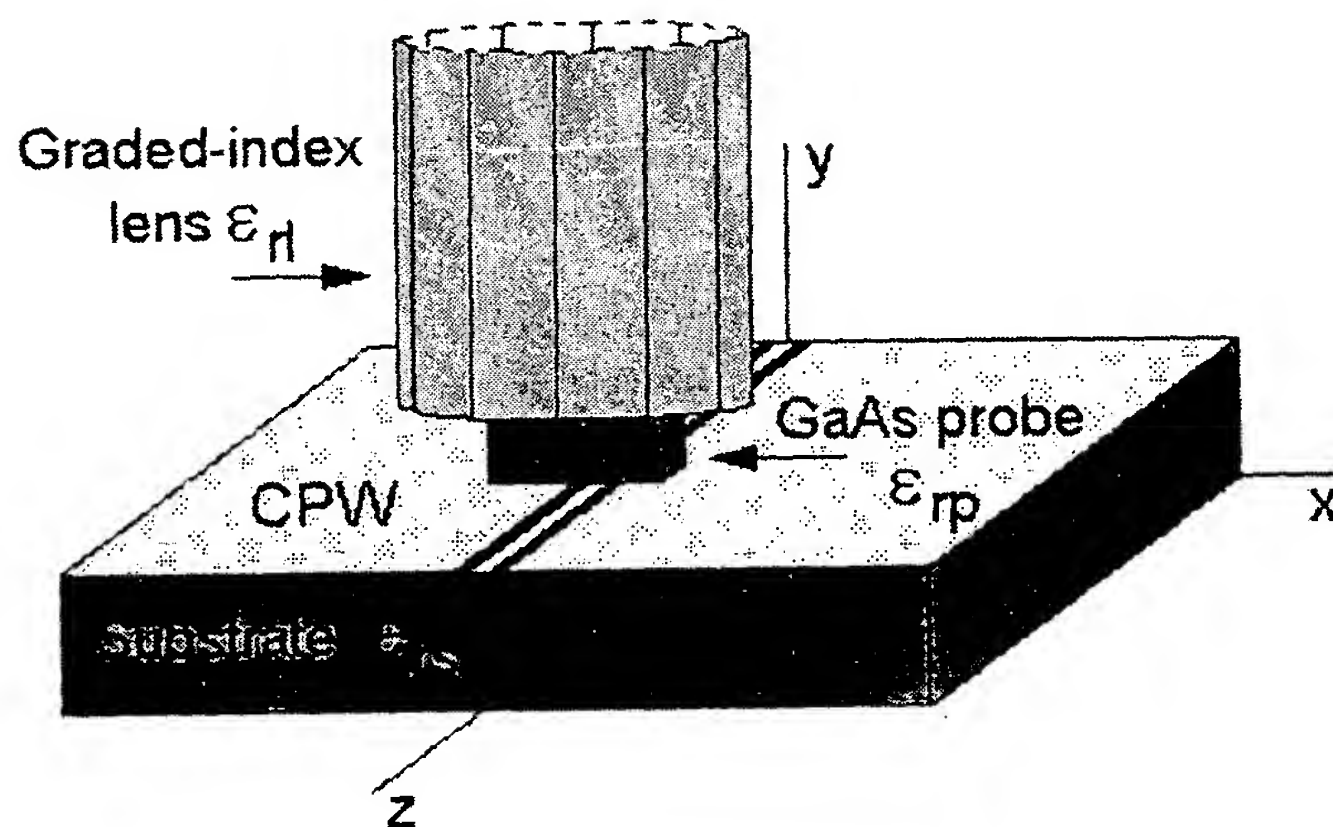
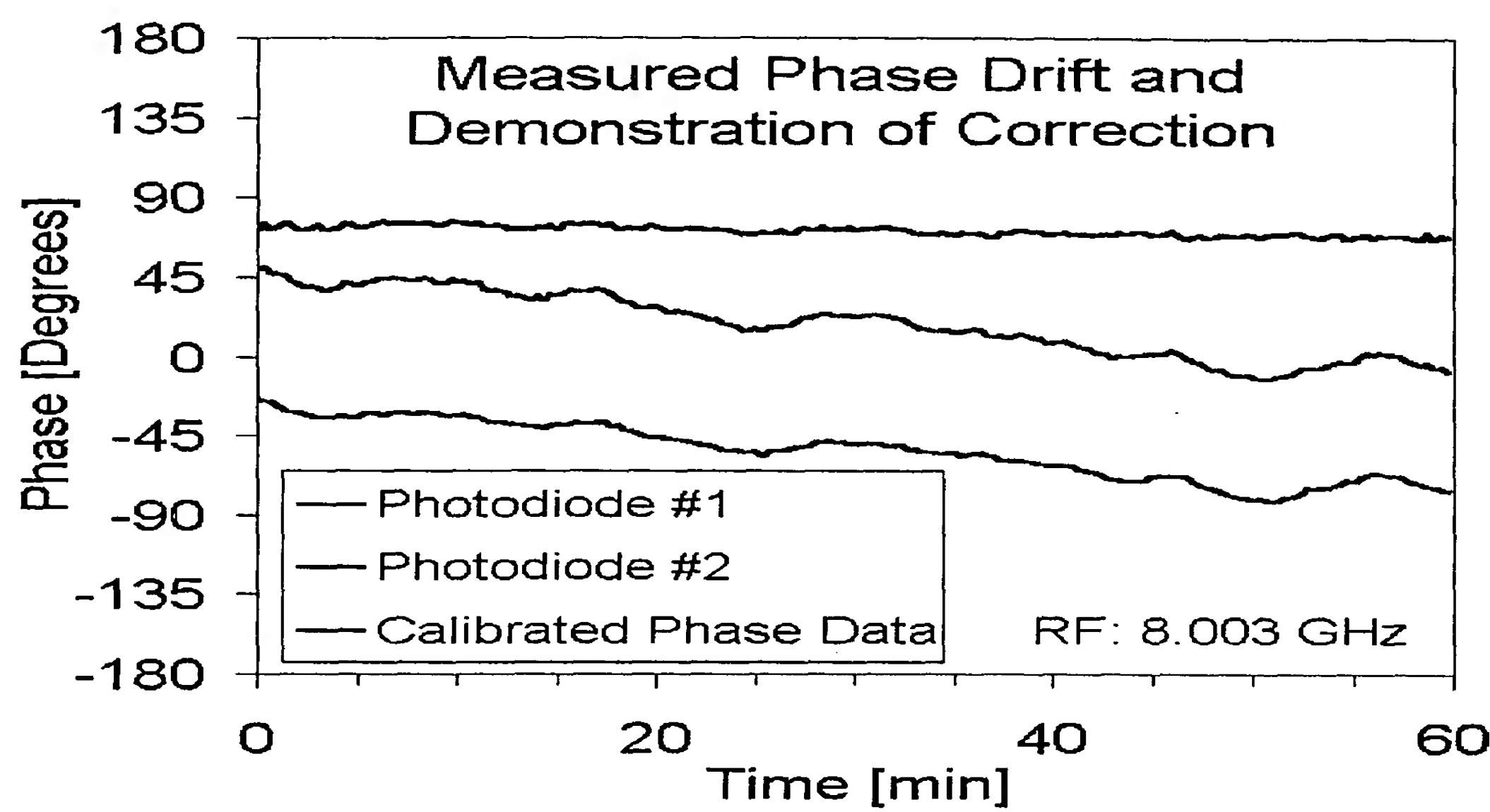


FIG. 14

CHARACTERIZATION – ELECTRIC FIELD PHASE



Over one hour, measured temporal phase stability is $\pm 3^\circ$

FIG. 15

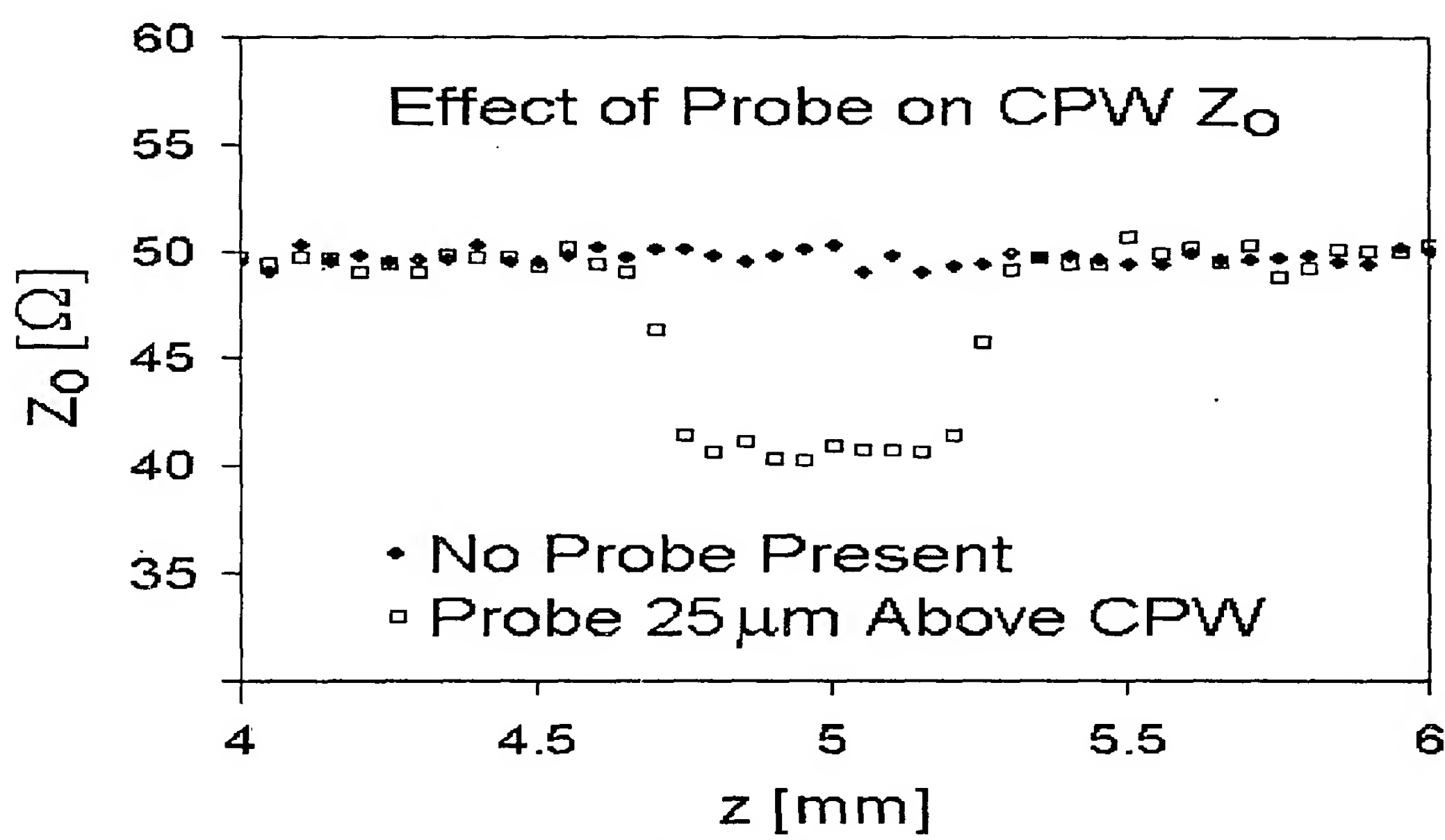
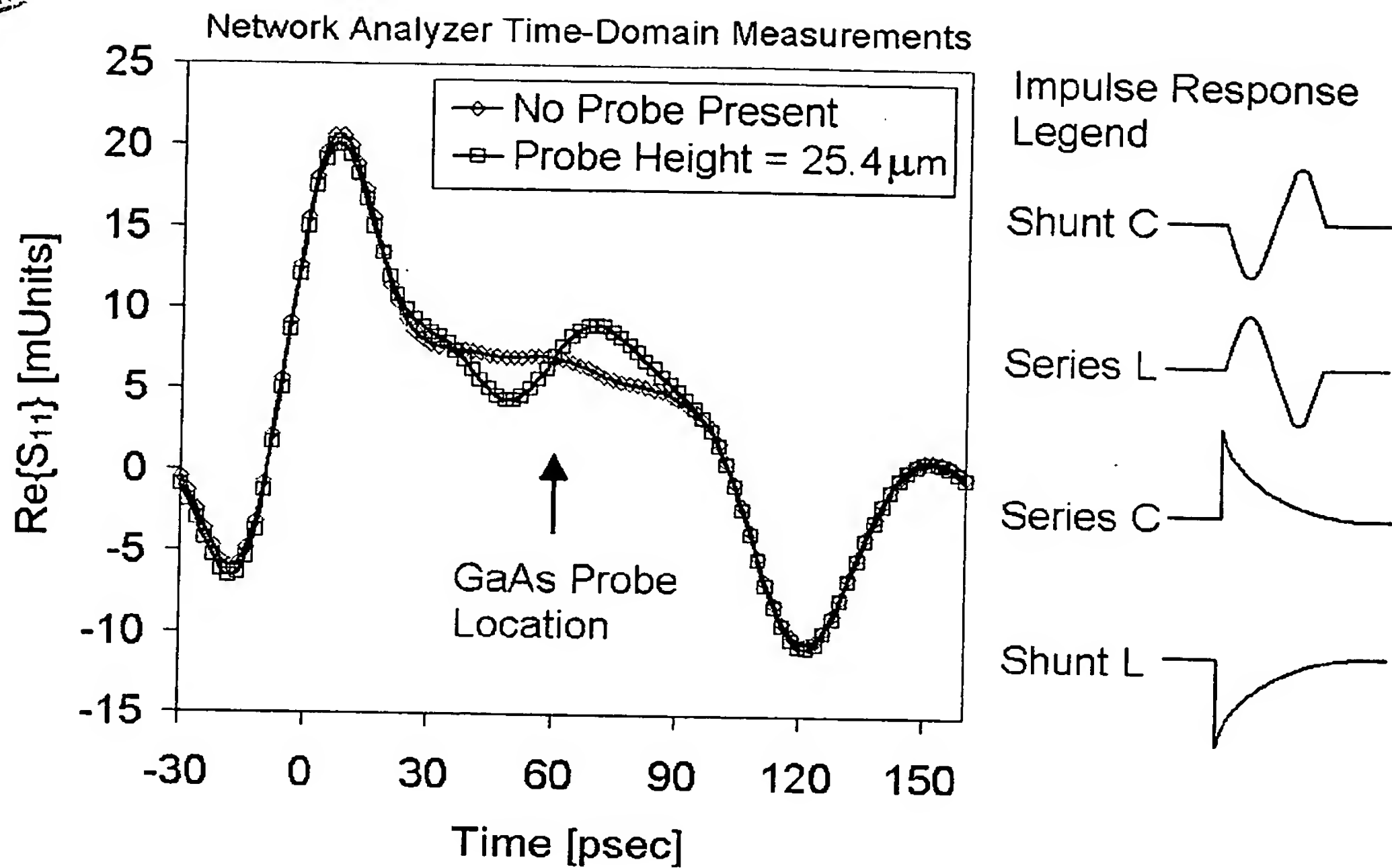


FIG. 16



• Frequency domain measurements (2 - 40 GHz):
 $|S_{11}| < -30\ \text{dB}$ with and without probe.

FIG. 17

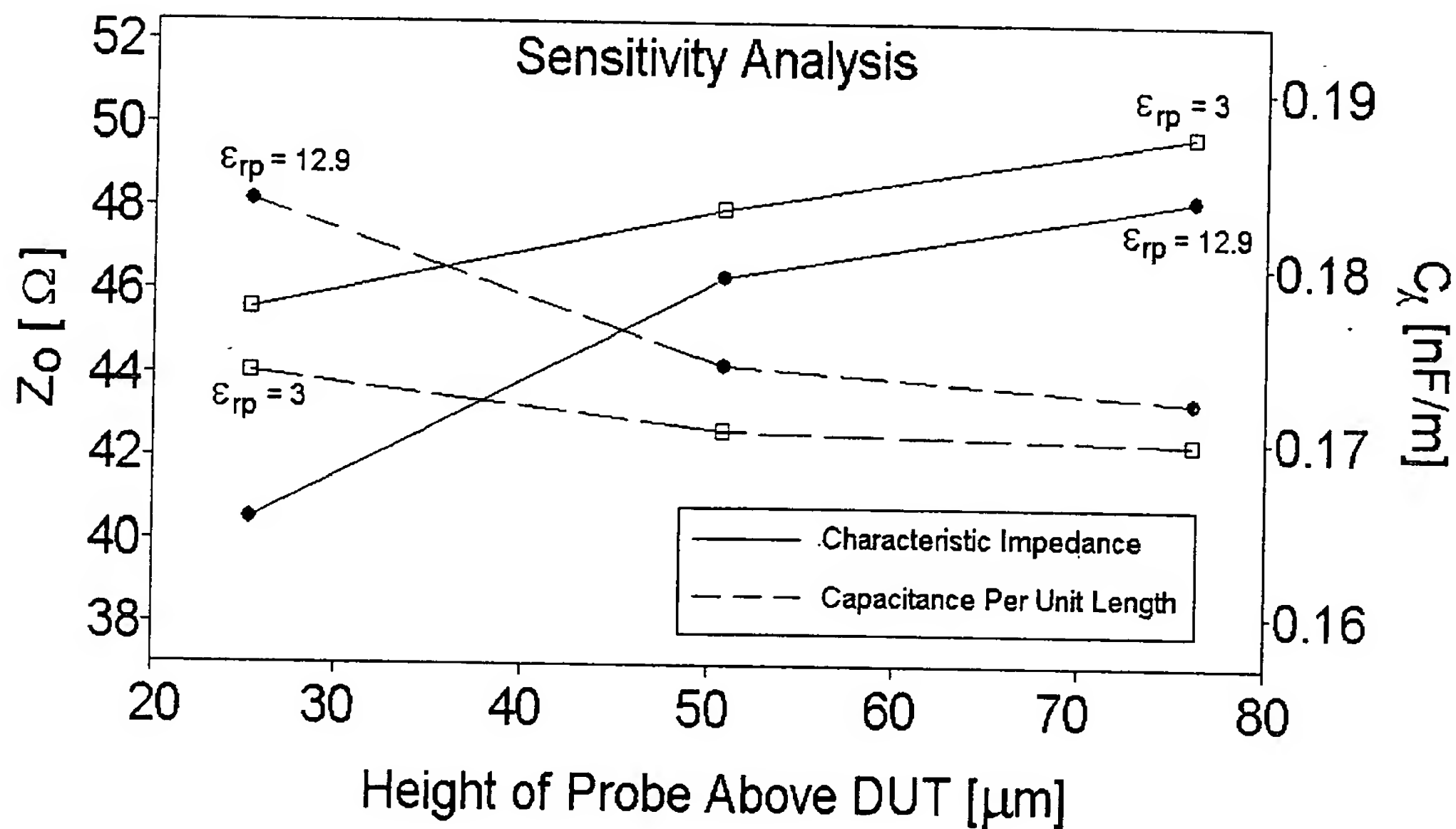


FIG. 18

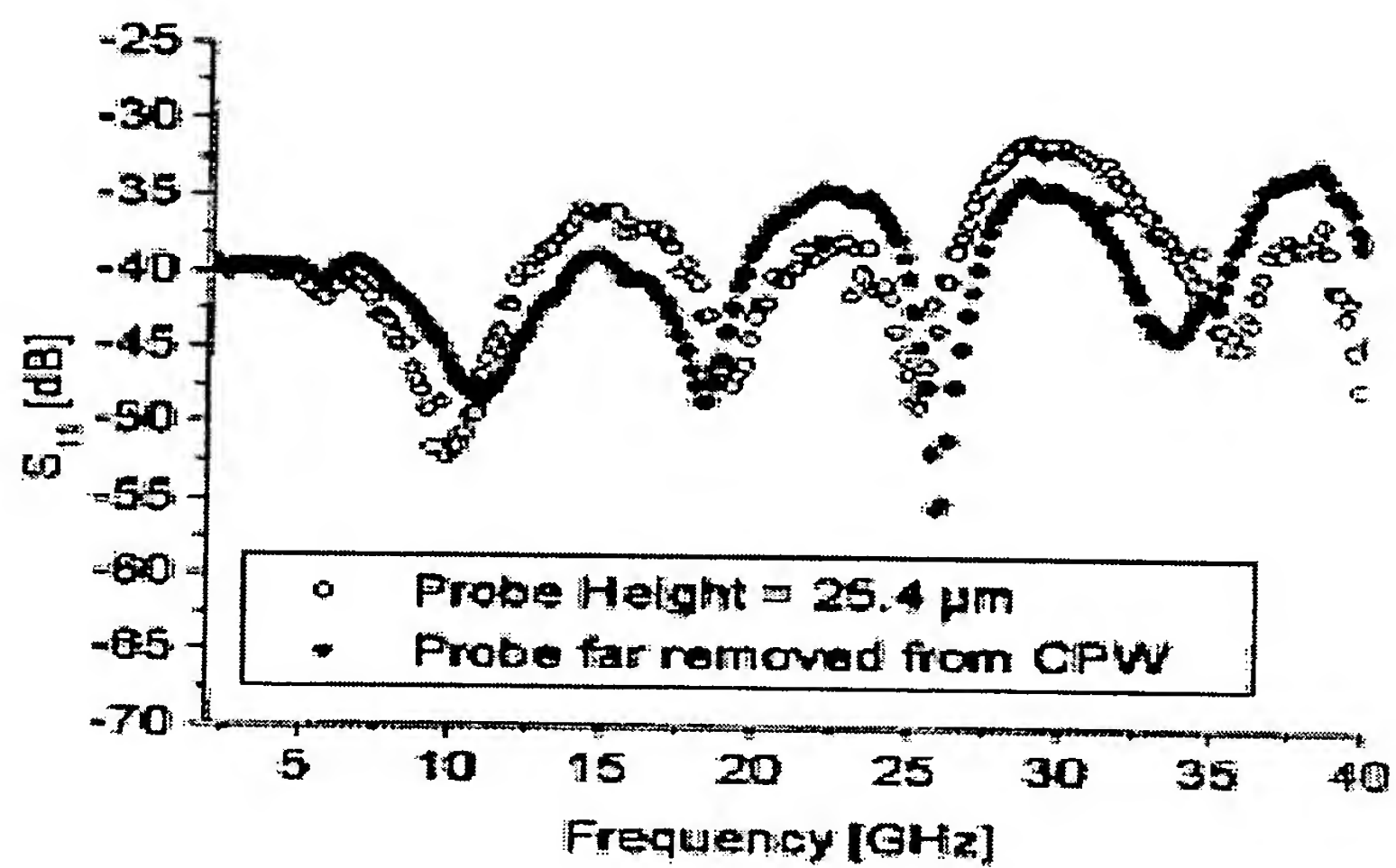


FIG. 19

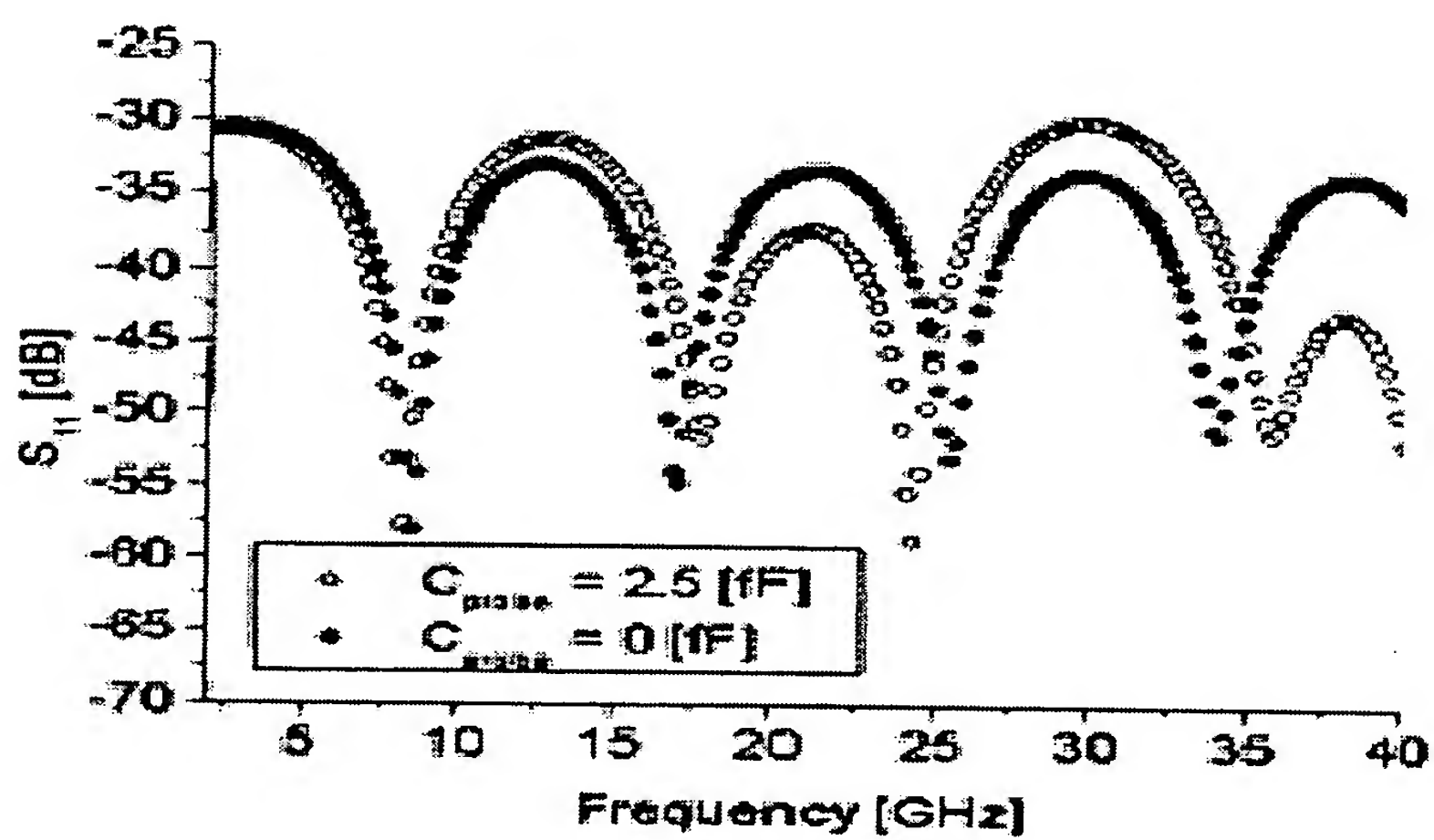


FIG. 20

Probe Vs Power Meter

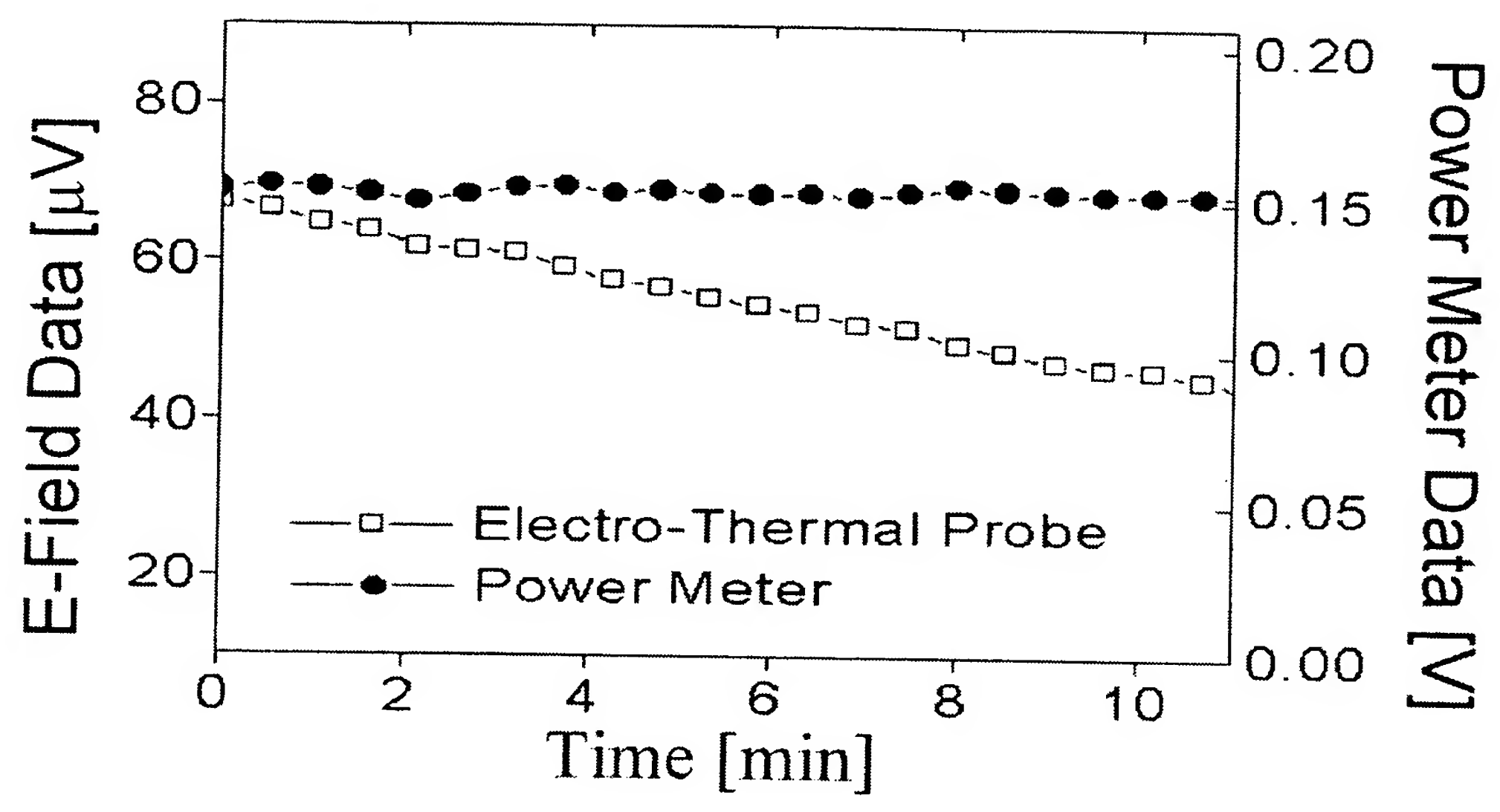


FIG. 21

Modulation Vs Absorption

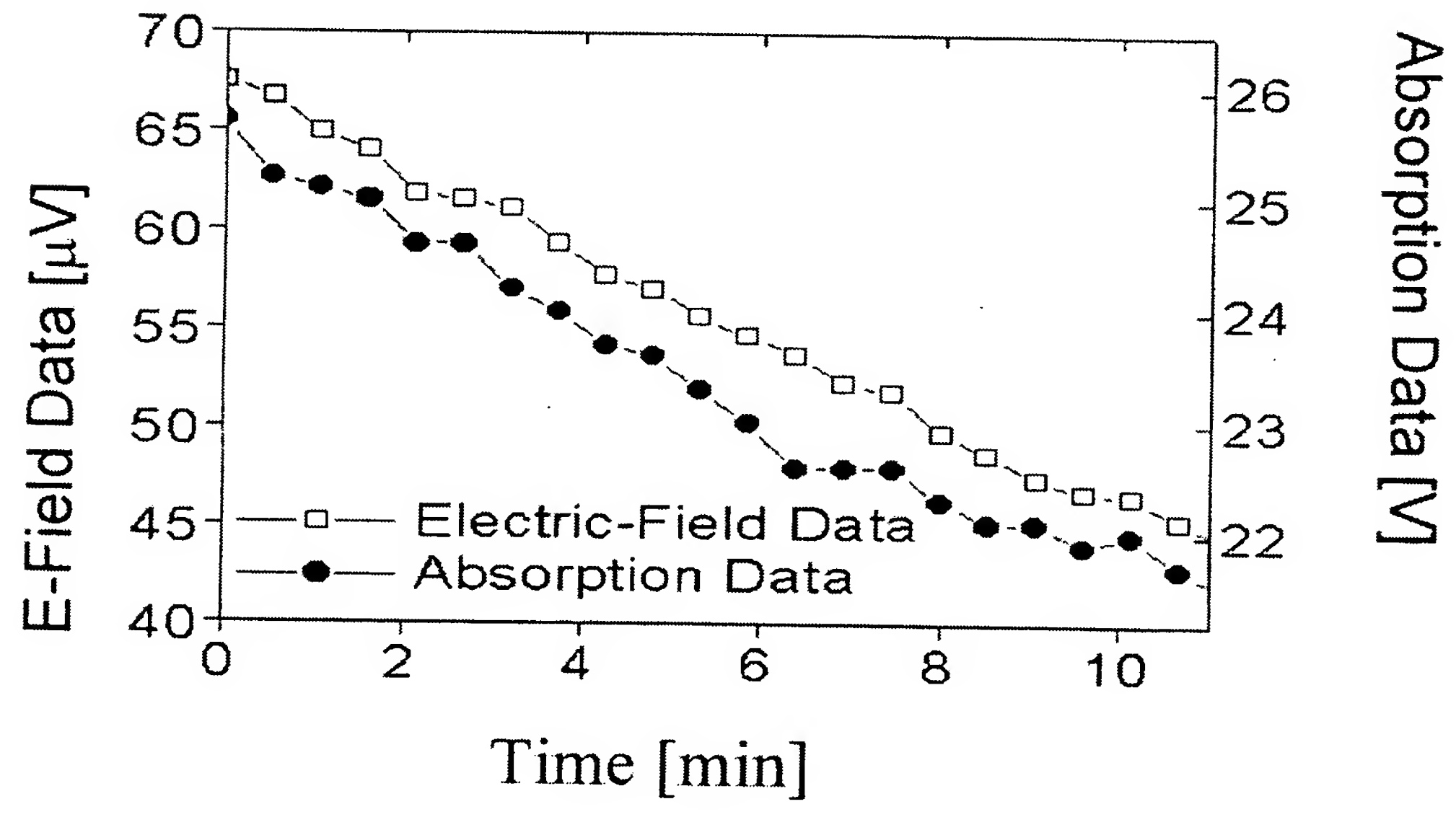


FIG. 22

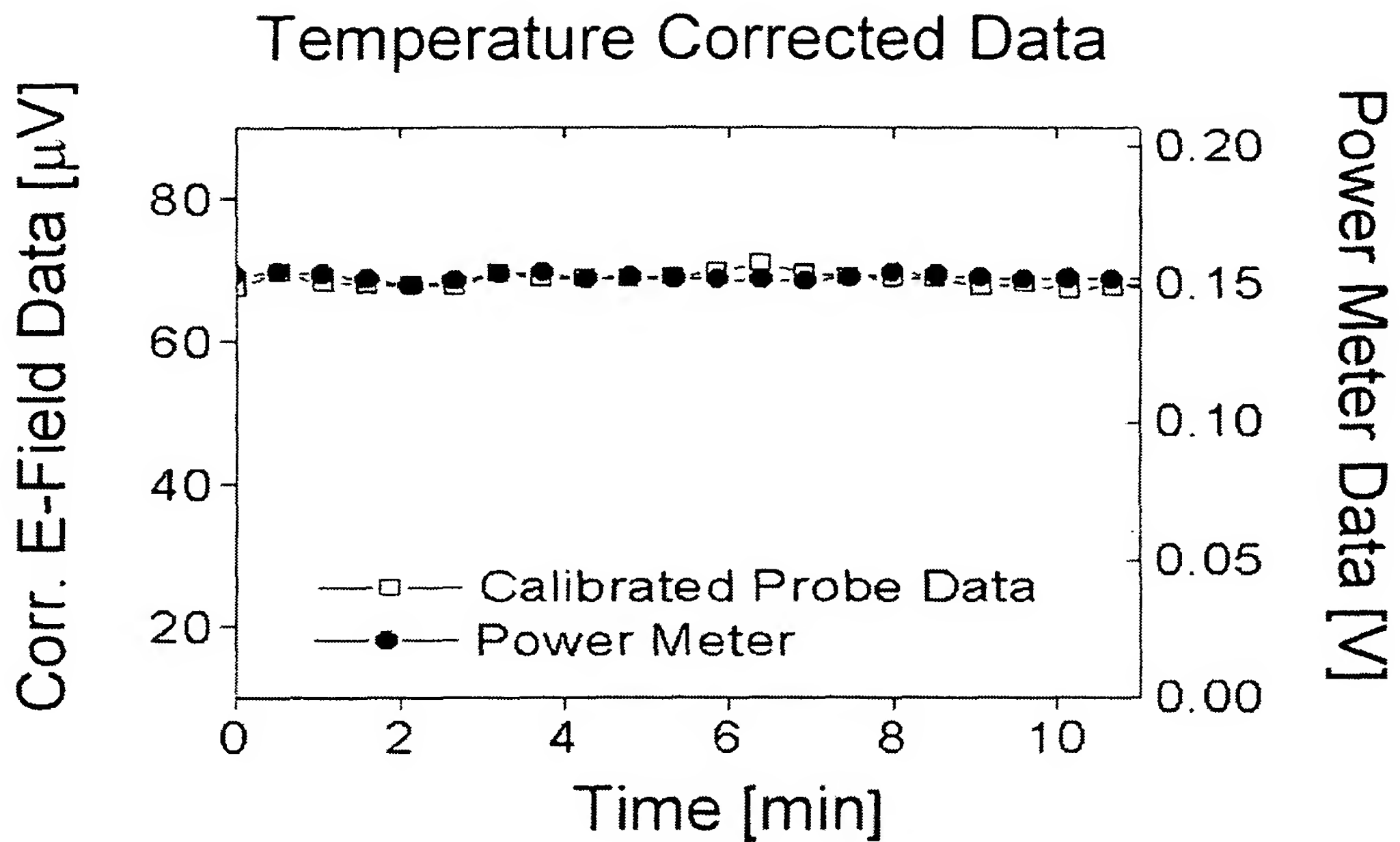


FIG. 23

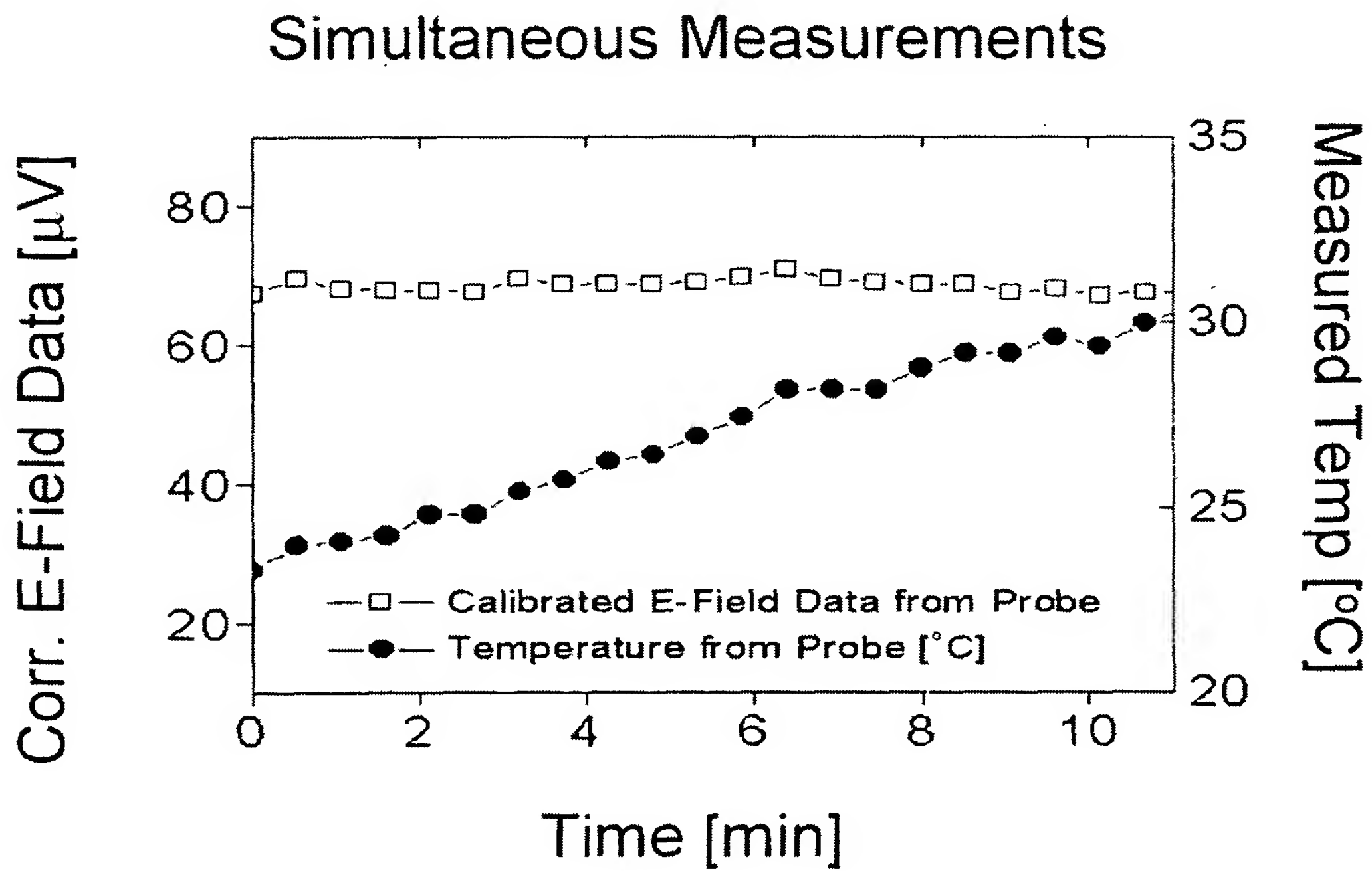


FIG. 24